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## Four new species of *Sphaeronemoura* (Plecoptera: Nemouridae) from Thailand and Vietnam<sup>1</sup>

I. SIVEC & B.P. STARK

**Abstract:** Four new species of *Sphaeronemoura* SHIMIZU & SIVEC are described from Thailand and Vietnam, compared with other regional members of the genus and a modified key for males is given. New taxa include *Sphaeronemoura malickyi* nov.sp., *S. poda* nov.sp., *S. shimizui* nov.sp. and *S. spinacercia* nov.sp. Two unassociated females are described under informal designations and an updated species checklist is presented.

**Key words:** *Sphaeronemoura*, Plecoptera, Nemouridae, Thailand, Vietnam, new species.

### Introduction

SHIMIZU & SIVEC (2001) proposed genus *Sphaeronemoura* for a group of six Asian nemourid stoneflies whose larvae have unusually shaped cercal segments (ZWICK & SIVEC 1980). The genus is also characterized by an elongate flagellum on the male epiproct apex, and by poorly developed male paraprocts which bear a small mesoapical lobe. Seven species are currently recognized in the group since the recent addition of *S. songshana* LI & YANG from China (LI & YANG 2009; DEWALT et al. 2009), and others are expected as the Asian nemourid fauna is more fully documented. *Sphaeronemoura inthanonica* SHIMIZU & SIVEC is the only member of the genus known from Thailand (SHIMIZU & SIVEC 2001) and no representatives are known from Vietnam.

The current study includes material of three undescribed species of *Sphaeronemoura* collected as part of a broader survey of aquatic insects of Thailand by Professor Dr. P. Chantaramongkol and members of the Chiang Mai University team, and by the senior author and a colleague from the Slovenian Museum of Natural History; an additional undescribed species was collected in Vietnam by B. Hubley of the Royal Ontario Museum and a female specimen was contributed by W. Mey of the Zoologisches Museum der Humboldt-Universität, Berlin. Specimens are deposited in the Slovenian Museum of Natural History, Ljubljana (PMSL), the Royal Ontario Museum, Toronto (ROM) or the Zoologisches Museum der Humboldt-Universität, Berlin (ZMB) as indicated in the text.

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<sup>1</sup> This paper is dedicated to Prof. Dr. Hans Malicky on the occasion of his 75<sup>th</sup> birthday.

## Description of species

### *Sphaeronemoura malickyi* nov.sp. (Figs 1-4)

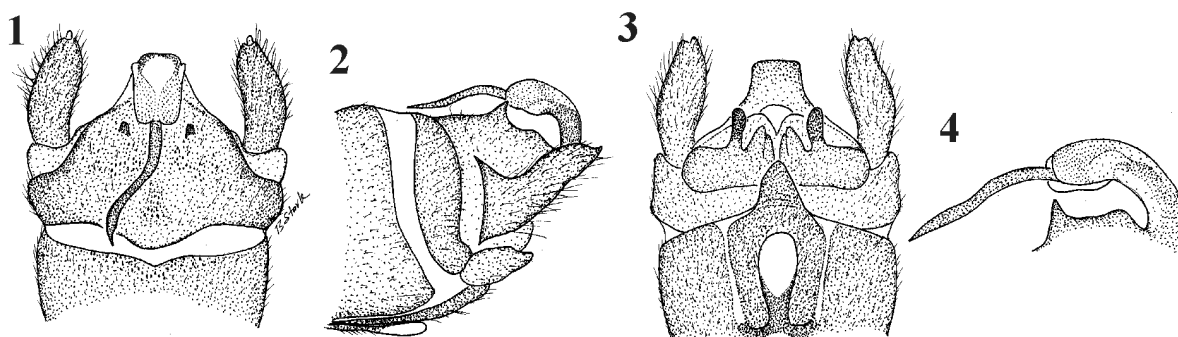
**H o l o t y p e :** ♂ from Thailand, Chiang Mai Province, Doi Inthanon National Park, Huai Sai Lueng, 98°27'E/18°31'N, 1060 m, 6 April 1993, I. Sivec, B. Horvat (PMSL). **P a r a t y p e s :** Thailand: Type locality, 16 November-7 December 2002, 1 ♂ (PMSL).

**Adult habitus.** General color brown to pale brown. Head pale brown without distinctive pattern. Pronotum brown with darker rugosities clustered midlaterally; legs brown.

**Male.** Forewing length 10 mm. Sclerotized projections of tergum 10 blunt (Fig. 1). Cerci long, slightly curved near base and narrowed to a sharp apex in lateral aspect. Epiproct flagellum long, slender and curved dextrally in dorsal aspect (Fig. 1); apex of flagellum acute (Figs. 2, 4). Paraproct outer lobes thumb shaped, apically swollen, and more sclerotized and longer than inner lobes (Fig. 3). Vesicle typical of genus.

**Female.** Unknown.

**Nymph.** Unknown.



**Figs 1-4:** *Sphaeronemoura malickyi*. (1) Male terminalia, dorsal. (2) Male terminalia, lateral. (3) Male terminalia, ventral. (4) Male epiproct, lateral.

**D i a g n o s i s .** This species is distinguished from other *Sphaeronemoura* by the dextrally curved, slender and apically acute epiproct flagellum. The thumb-like outer paraproct lobes are somewhat similar to those of *S. inthanonica* but in that species these lobes are stouter and the epiproct flagellum is not acute. In the key presented by SHIMIZU & SIVEC (1980) *S. malickyi* males are identified as *S. hamistyla* (WU), but in the figures presented by Wu (1962) and LI & YANG (2009) the epiproct flagellum for that species is shown to be apically blunt and strongly curved near the tip.

**E t y m o l o g y .** The patronym honors our colleague Prof. Dr. Hans Malicky in recognition of his help in collecting Asian stoneflies.

***Sphaeronemoura poda* nov.sp. (Figs 5-7)**

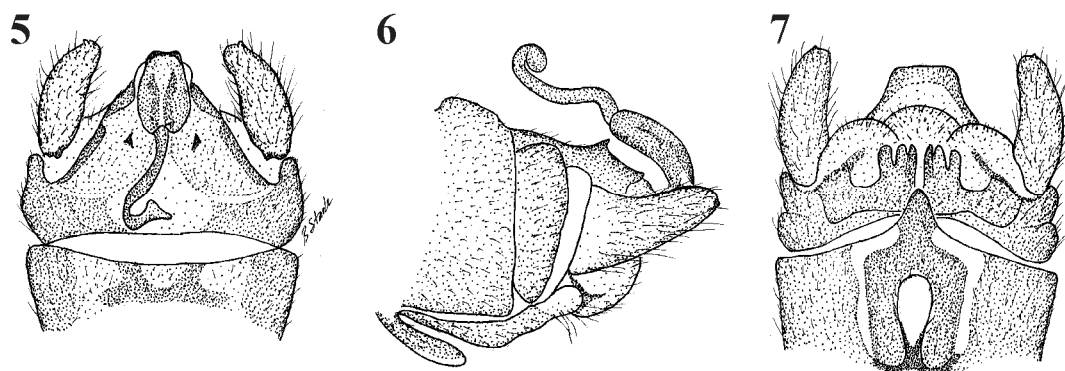
**H o l o t y p e :** ♂ and 1♂ p a r a t y p e from Thailand, Phitsanulok Province, Phu Hin Rongkla National Park, Waterwheel Falls, 101°00'E/16°59'N, 1280 m, 10 March 2002, Chiang Mai University team (PMSL).

**Adult habitus.** General color brown. Legs uniformly brown.

**Male.** Forewing length 8 mm. Sclerotized projections of tergum 10 short and acute (Figs 5-6). Cerci cylindrical but slightly narrowed apically; cercal spine absent. Epiproct flagellum long, slender, curved strongly to the right near apex in dorsal aspect (Fig. 5) and curved dorsad in lateral aspect (Fig. 6); apex of flagellum somewhat foot shaped in dorsal aspect. Paraproct outer lobes slender, equal in length to inner lobes and not swollen at tips (Fig. 7). Vesicle typical of genus.

**Female.** Unknown.

**Nymph.** Unknown.



**Figs 5-7:** *Sphaeronemoura poda*. (5) Male terminalia, dorsal. (6) Male terminalia, lateral. (7) Male terminalia, ventral.

**D i a g n o s i s .** The foot shaped apex of the epiproct flagellum is distinctive for this species which is identified as *S. hamistyla* WU in the key proposed by SHIMIZU & SIVEC (2001).

**E t y m o l o g y .** The species name is based on the foot shaped apex of the epiproct flagellum.

***Sphaeronemoura shimizui* nov.sp. (Figs 8-10)**

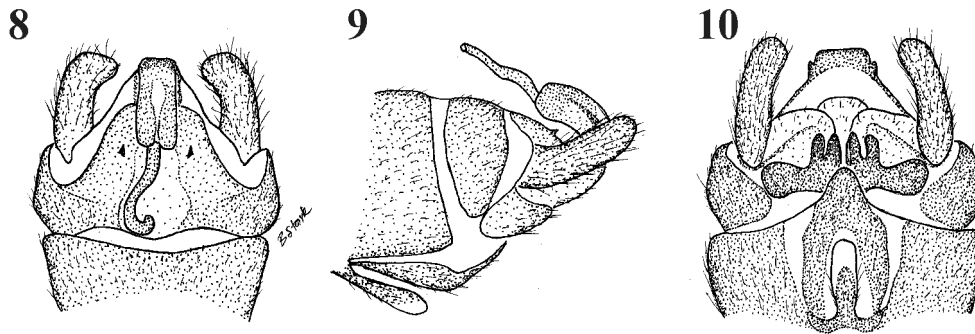
**H o l o t y p e :** ♂ from Vietnam, Lao Cai, ca. 12 km on road from Sapa to Lau Chau, 1950 m, 22°20'58.3"N/103°96'15.7"E, 1-12 May 1999, ROM 992002, B. Hubley (ROM).

**Adult habitus.** General color brown. Legs uniformly brown.

**Male.** Forewing length 9 mm. Sclerotized projections on tergum 10 small and acute (Fig. 8). Cerci cylindrical, curved inwards at tips and without spines. Epiproct flagellum slender, hooked sinistrally at the tip and blunt (Figs 8-9). Paraproct outer lobes thumb shaped and similar in size to inner lobes (Fig. 10). Vesicle typical of genus.

**Female.** Unknown.

**Larva.** Unknown.



**Figs 8-10:** *Sphaeronemoura shimizui*. (8) Male terminalia, dorsal. (9) Male terminalia, lateral. (10) Male terminalia, ventral.

**D i a g n o s i s .** The epiproct flagellum and tergal spines on 10 are similar for this species to those of *S. hamistyla*, however the outer paraproct lobes for that species are wider than the inner lobes.

**E t y m o l o g y .** The patronym honors our colleague, Takao Shimizu, in recognition of his contributions to the knowledge of this interesting genus.

### ***Sphaeronemoura spinacercia* nov.sp. (Figs 11-15)**

**H o l o t y p e :** ♂ and ♀ paratype from Thailand, Chiang Mai Province, Doi Inthanon, Huai Sai Lueng, 98°27'E, 18°31'N, 1060 m, 7-8 May 2002, Chiang Mai University team (PMSL). **P a r a t y p e s :** Thailand: Type locality, 9 May-8 June 2002, 1 ♀ (PMSL). Same site, 4 April-3 May 2003, 3 ♀ ♀ (PMSL). Loei Province, Phu Hin Rongkla National Park, Huai Man Daeng Noi, 101°03'E/16°57'N, 1600 m, 22 May 2002, 1 ♀ (PMSL). Same site, 21 September-21 October 2002, 1 ♀ (PMSL). Same site, 20 July-23 August 2002, 1 ♀ (PMSL).

**Adult habitus.** General color brown. Head and pronotum dark brown, slightly darker pronotal rugosities scattered along midline. Legs uniformly brown.

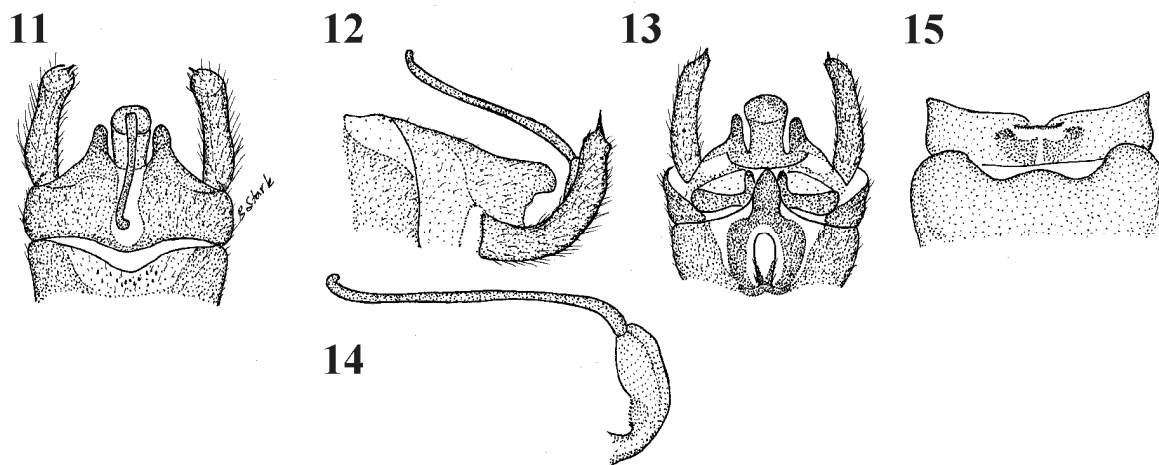
**Male.** Forewing length 8 mm. Sclerotized projections of tergum 10 indistinct. Cerci long, curved dorsad and bearing a slender apical spine and a smaller subapical spine on the ventral margin (Figs 11-13). Epiproct flagellum long, slender and curved dorsad near tip (Figs 12, 14). Paraproct outer lobes narrow at tips, subequal in length to inner lobes (Fig. 13). Vesicle typical of genus.

**Putative Female.** Forewing length 11 mm. Pregenital plate broadly emarginate with a small mesal projection; lateral lobes project over base of sternum 8 (Fig. 15). Sternum 8 notched on posteromesal margin and a small, poorly sclerotized plate is located forward of notch.

**Nymph.** Unknown.

**D i a g n o s i s .** Because the projections of tergum 10 are indistinct for this species, it is identified as *S. paraproctalis* (AUBERT 1967) in the key proposed by SHIMIZU & SIVEC (2001). These species, however are clearly distinguished by the long, apically curved epiproct flagellum and by the cercal spines found in *S. spinacercia*.

**E t y m o l o g y .** The species name is based on the apical and subapical cercal spines.



**Figs 11-15:** *Sphaeronemoura spinacercia*. (11) Male terminalia, dorsal. (12) Male terminalia, lateral. (13) Male terminalia, ventral. (14) Male epiproct, lateral. (15) Female terminalia, ventral.

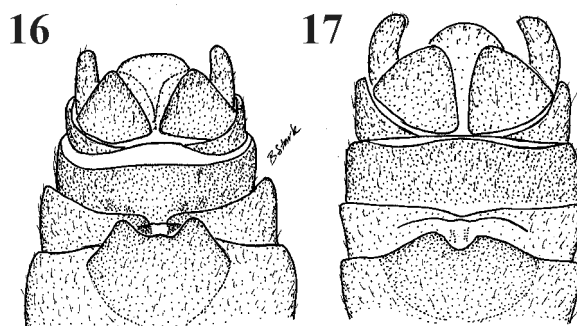
### ***Sphaeronemoura* Vn A (Fig. 16)**

**Material:** Vietnam: Lao Cai, Sapa, Fan Si Pan Mountains, 25-30 March 1995, W. Mey, 1 ♀ (ZMB).

**Adult habitus.** General color dark brown. Head and antennae uniformly dark brown, pronotum brown with obscure rugosities. Legs banded, hind femora and tibiae each with a pale yellow band. Wings dark brown.

**Male.** Unknown.

**Female.** Forewing length 15.5 mm. Pregenital plate broadly excavated mesally and reaching over much of sternum 8; plate outline exclusive of notch subquadrangular (Fig. 16). Subgenital plate consists of a median and two lateral sclerites.



**Figs 16-17:** *Sphaeronemoura* spp. female terminalia, ventral. (16) *S. Vn A*. (17) *S. Vn B*.

***Sphaeronemoura* Vn B (Fig. 17)**

**M a t e r i a l :** Vietnam: Lao Cai, tributary Muong Hoa Ho River, 15 km E Sapa, 926 m, 10 May 1995, ROM 956033, D. Currie, B. Hubley, J. Swann, 1 ♀ (ROM).

Adult habitus.

Male. Unknown.

Female. Forewing length 10 mm. Pregenital plate with a broad median notch; plate outline exclusive of notch subtriangular (Fig. 17). Sternum 8 poorly sclerotized, bearing a small median notch.

**Key to *Sphaeronemoura* males**

The following modification is offered for the SHIMIZU & SIVEC (2001) key to aid in recognition of these four species and their relatives. *Sphaeronemoura songshana* LI & YANG from China is not included because we are uncertain about the presence in that species of a few characters used in the key.

- |   |  |                         |
|---|--|-------------------------|
| 1 | Epiproct with a straight flagellum at the apex.....  | <i>S. elephas</i>       |
| - | Epiproct with curved flagellum (Fig. 1).....   | 2                       |
| 2 | Legs brown with wide yellow femoral band.....  | <i>S. inthanonica</i>   |
| - | Legs uniformly brown.....  | 3                       |
| 3 | Tergum 10 unmodified.....  | 4                       |
| - | Tergum 10 with a projection on either side near epiproct (Fig. 1).....   | 5                       |
| 4 | Epiproct flagellum in dorsal aspect shaped like a question mark; outer lobe of paraproct apically swollen; cerci without apical or subapical spine .....                                 | <i>S. paraproctalis</i> |
| - | Epiproct flagellum in dorsal aspect long, slender and hooked at tip (Fig. 11); outer lobe of paraproct narrowed at tip (Fig. 13); cerci with apical and subapical spines (Fig. 12) ..... | <i>S. spinacercia</i>   |
| 5 | Tergum 8 unmodified.....   | 6                       |
| - | Tergum 8 modified, protruding posteriorly.....   | 9                       |
| 6 | Apex of epiproct flagellum expanded, foot shaped (Fig. 5).....   | <i>S. poda</i>          |
| - | Apex of epiproct flagellum slender, cylindrical or acute .....   | 7                       |
| 7 | Apex of epiproct flagellum acute and slightly sinuate (Fig. 1).....  | <i>S. malickyi</i>      |
| - | Apex of epiproct flagellum cylindrical and strongly hooked.....  | 8                       |
| 8 | Outer paraproct lobe slightly wider than inner lobe.....   | <i>S. hamistyla</i>     |
| - | Outer paraproct lobe narrower than inner lobe (Fig. 10) .....  | <i>S. shimizui</i>      |
| 9 | Tergum 8 with large posteromesal lobe; rounded projection of paraproct short .....   | <i>S. plutonis</i>      |
| - | Tergum 8 with small posteromesal lobe; rounded projection of paraproct long.....   | <i>S. formosana</i>     |

## Checklist of *Sphaeronemoura* Species

*S. elaphas* (ZWICK, 1974) [Taiwan]  
*S. formosana* SHIMIZU & SIVEC 2001 [Taiwan]  
*S. hamistyla* (WU, 1962) [China]  
*S. inthanonica* SHIMIZU & SIVEC 2001 [Thailand]  
*S. malickyi* nov.sp. [Thailand]  
*S. paraproctalis* (AUBERT, 1967) [India]  
*S. poda* nov.sp. [Thailand]  
*S. plutonis* (BANKS, 1937) [Taiwan]  
*S. shimizui* nov.sp. [Vietnam]  
*S. songshana* LI & YANG, 2009 [China]  
*S. spinacercia* nov.sp. [Thailand]

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## Zusammenfassung

Vier neue Arten von *Sphaeronemoura* (*S. malickyi*, *S. poda*, *S. shimizui*, *S. spinacercia*) werden aus Thailand und Vietnam beschrieben und mit den anderen sympatrischen Arten der Gattung verglichen, mit Anfügung eines verbesserten Schlüssels für die Männchen und einer neuen Liste der Arten der Gattung. Zwei unbenannte Weibchen werden beschrieben.

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Authors' addresses:

Ignac SIVEC  
Slovenian Museum of Natural History  
Prešernova 20, P.O. Box 290  
SLO-1001 Ljubljana, Slovenia  
E-mail: [isivec@pms-lj.si](mailto:isivec@pms-lj.si)

Bill P. STARK  
Department of Biology, Box 4045  
Mississippi College  
Clinton, Mississippi, U.S.A. 39058  
E-mail: [stark@mc.edu](mailto:stark@mc.edu)